California Environmental Protection Agency

Air Resources Board

SOURCE TEST REPORT

Total and Hexavalent Chromium Emissions From Walker's Custom Chrome Decorative Chromium Plating Tank

MONITORING AND LABORATORY DIVISION
STATIONARY SOURCE TESTING BRANCH

FILE NO: 06-05

DATE: July 5, 2006

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This report has been reviewed by the staff of the California Air Resources Board (ARB) and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the ARB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ACKNOWLEDGEMENTS

The project leader was Shobna Sahni assisted by Carla Takemoto and Robert Barrera with ARB Stationary Source Division. The sampling team was led by David Todd and included Angus MacPherson and Dan Leon with the ARB MLD and Robert Barrera with ARB Stationary Source Division. Roxana Walker and Peter Samra with MLD Northern Laboratory Branch conducted the laboratory analysis. Dominick Nole and Paramo Hernandez with Alta Plating provided chrome plating assistance and expertise. Paramo Hernandez of Alta Plating also provided onsite analyses for plating bath surface tension. Additional plating bath analysis was provided by Anachem.

This report presents results based on samples collected and analyzed by the ARB staff using ARB test methods. The results have been reviewed by the staff and are believed to be accurate within the limits of the methods. However, data may have been affected by variables that were not known to staff during sampling and review.

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California Environmental Protection Agency
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Total and Hexavalent Chromium Emissions from Walker's Custom Chrome Decorative Chromium Plating Tank

I. INTRODUCTION

At the request of the Air Resources Board (ARB) Stationary Source Division (SSD), staff of the Monitoring and Laboratory Division (MLD) performed emissions testing of a decorative chrome electroplating tank operated by Walker's Custom Chrome located at 2145 Grand Coulee Blvd. in Shasta Lake, California. Total and hexavalent chromium emissions testing was conducted from February 15 through February 23, 2006.

II. PROCESS DESCRIPTION

Walker's Custom Plating performs decorative chromium plating on a variety of small parts including decorative automobile parts. Walker's decorative chrome plating tank has a capacity of about 500 gallons and is 96 inches long, 29 inches wide, and 42 inches deep. The plating tank is equipped with its own rectifier, and amperage and voltage into the tank varies with the type and area of the parts to be plated. Plating bath temperature was maintained at approximately 95 - 105° F during plating operations. SSD staff periodically collected voltage, amperage, bath temperature, and amp-hour readings for the plating tank during the source test.

Emissions from the plating tank are controlled through the use of a chemical fume suppressant, Fumetrol 140, a South Coast Air Quality Management District (SCAQMD) certified fume suppressant for chromium electroplating. Chemical fume suppressants are used in plating baths to change the surface tension and reduce chromic acid mist that is generated during plating operations. No plating tank ventilation system or additional emissions controls are used (i.e. HEPA filter) at Walker's. Any emissions from the tank are emitted into the building and subsequently vented out through open doors, windows, and vents.

As mentioned above, Walker's normally performs decorative plating on a variety of small parts. Normal usage is about 40 to 60 amp-hours per day for about two or three days a week. For this source test decorative plating was increased to about 300 amp-hours per sample run (day) to insure a measured amount of chromium was collected. Dummy parts were plated instead of Walker's normal production. The dummy parts were hollow metal tubes about 36 inches long and either 1.5 inches in diameter or 1.5 by 1.5 inches square. Both types were used at five to six dummies at a time. Examples of the dummy parts are shown in Figure II-1. A total of 30 dummy parts were plated for

each of three sample runs (W-11, W-12, and W-13). A fourth sample run (W-14) was collected without any chromium electroplating in the tank.

Fig II-1: A sample of the dummy parts chromium electroplated during emissions sampling.

III. WALKER'S CUSTOM CHROME SOURCE TEST

The source test consisted of four individual sample runs. Three sample runs were collected from Walker's decorative chrome plating tank on February 15, 16 and 17, 2006. During these sample runs the surface tension of the plating solution was about 35 dynes/cm which is a normal operating condition for this facility. A fourth "blank" sample run was collected February 23, 2006, while the plating tank remained "idle."

ARB Method 425 was used to determine hexavalent and total chromium emissions collected during the source tests. Each sample was collected continuously over a four-hour period except the first sample (W-11) which was collected over a two-hour period. During sampling, “dummy” parts were plated in the tank. The dummy parts were necessary to obtain a target of about 300 amp-hours per run. Walker’s Custom Chrome staff prepared each dummy part for plating, including stripping, each time a part reentered the plating tank.

ARB staff built a ventilation system to carry any chromium emitted by the plating tank to the source sampling area,(See Figures III-1 and III-2.). This ventilation system consisted of a capture hood with an open bottom, open front, and plastic sheeting on three sides and the top. A 12-inch diameter exhaust duct near the top back center of

Fig III-1: Walker’s decorative chromium plating tank with ARB capture hood and ducting.

the capture hood carried plating tank emissions from the tank and capture hood through a sample collection area and then out toward an exit door. Surfaces of the hood and duct assembly were made of plastic sheeting and PVC flex hose and rigid tubing. This system was designed to allow droplets to return to the tank but collect fumes that

floated above the tank. Per SCAQMD's procedures for plating tanks and fume suppressant certification, the average "lift" velocity between the tank and the ventilation system was designed to be less than 50 feet/minute.

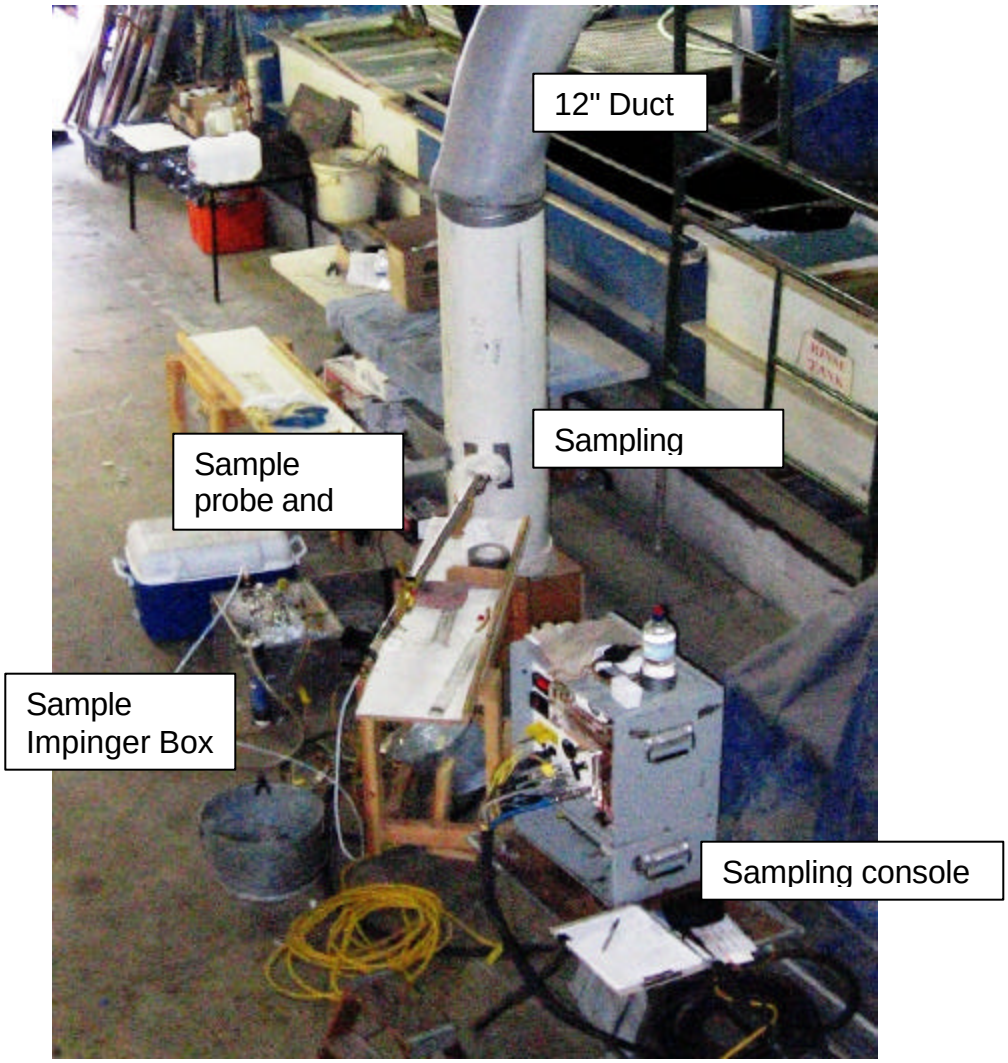

Fig. III-2: ARB sampling location including vertical sampling pipe (12-inch diameter) and sample collection setup.

The capture hood was suspended above and around the plating tank by PVC pipes. When suspended and in use, the bottoms of the capture hood plastic sidewalls overlapped the back and sides of the plating tank. The open front of the capture hood was high enough and wide enough to allow plating parts to be placed in the tank without interference. "Smoke" sticks were used before and during sample runs to prove there was no emissions "leakage" out of the hood, including the open front. That "smoke," titanium oxides and hydrochloric acid does not interfere with ARB Method 425 sample collection and analysis.

Flexible and rigid (straight) 12-inch diameter PVC pipe directed tank emissions from the capture hood to the ARB Method 425 sample collection area. Method 425 samples were collected from a vertical (12-inch diameter, 67 inches long) PVC pipe sitting on the inlet to a fan box. Samples were collected from two, three-inch diameter holes cut 90 degrees apart into the vent stack and located 18 inches (1½ duct diameters) above the fan box and 49 inches (four duct diameters) below the flexible pipe connected to the capture hood.

The fan box includes a variable flow controlled fan with a 5-foot, 12-inch diameter PVC rigid pipe to exhaust tank emissions.

IV. TEST METHODS

A. Source Sampling Procedures

Samples were collected and recovered by ARB's Stationary Source Testing Branch. Stack and duct flows were determined by ARB Stationary Source Test Method 1 (velocity traverse), Method 2 (stack velocity and flow rate), Method 3 (stack gas dry molecular weight), and Method 4 (moisture content). For Method 3, atmospheric concentrations of carbon dioxide, nitrogen, and oxygen were used to determine dry molecular weight.

Hexavalent and total chromium samples were collected isokinetically in accordance with ARB draft Method 425, "Determination of Total Chromium and Hexavalent Chromium Emissions from Stationary Sources." ARB Method 425 was originally adopted January 22, 1987, and amended July 28, 2002. For chromium sampling at Walker's there were some approved modifications to ARB Method 425. These include the use of unheated sample lines and probes, the use of 0.1 N sodium bicarbonate impinger solution in place of 0.1 N sodium hydroxide solution, and deletion of the sample train filter and filter heater.

Each test day consisted of a four-hour run using a single sample train, except for the first run which was only two hours. During the first run (Run W-11), 300 amp-hours of plating were unexpectedly completed within two hours. As a result, that run was reduced to two hours and only one diameter was traversed.

The chromium sampling train consisted of a 48-inch glass-lined stainless steel probe with a 3/8-inch diameter glass nozzle, and attached Pitot tube and thermocouple assembly for monitoring stack conditions. A ten-foot Teflon™ line connected the probe to three Greenburg-Smith impingers used to collect and stabilize any chromium sample. The first two impingers contained 100 milliliters each of 0.1 normal (N) sodium bicarbonate solution. A third, empty impinger was followed by a cylinder of silica gel (final moisture collection), and a 25-foot umbilical line connected to an isokinetic (Method 5) sampling console. The sampling console includes a

vacuum pump, a dry gas meter, and additional monitors and controls for collecting a sample isokinetically.

In accordance with Method 1, the sampling location required 24 traverse points (12 sampling points on each diagonal ninety degrees apart). As indicated above, Run W-11 was on only one diagonal. All the other sample runs including the blank (Run W-14) were completed using two diagonals.

In accordance with Method 2, thermocouples and Type S Pitot tubes bundled with the sampling probes were used to determine stack velocity. The weight of the impinger solutions and silica gel were recorded before and after each test in order to obtain the moisture content of the stack gas in accordance to Method 4. In addition, stack temperature, ambient temperature, and barometric pressure were measured and recorded during each sample run. Leak checks in accordance with Method 5 were performed on each sample train and Pitot tube setup before and after each sample collection. Leak check results were documented on the Method 425 run sheets.

After sampling, rinses of the sampling train nozzle, probe and transfer line, as well as the catch from the impingers, were recovered into three, 500-ml glass sample jars as follows (all sample jars were pre-cleaned and tested to ensure the absence of chromium prior to the source test):

- Container 1 - rinses from the nozzle, sample probe, and transfer line;
- Container 2 – first impinger catch; and
- Container 3 – second and third impinger catches.

The pH of the sodium bicarbonate solution used for the probe rinse and impingers was maintained at ≥ 8.0. Additionally, the impinger solution was chilled with ice to 4°C (39°F) or less during sample collection. All samples were also chilled with ice and refrigeration to 4°C (39°F) or less during transport and storage prior to analysis to minimize the conversion of hexavalent chromium to trivalent chromium. During sample recovery prior to analysis, disposable vinyl gloves were worn to help prevent contamination. At the conclusion of each sampling week, staff transported the collected samples to the laboratory for storage and analyses.

Amperage and voltage supplied by the rectifier was monitored by SSD staff during the source test runs. SSD staff also monitored tank temperature and totalizer amp-hours. In addition, plating bath samples were collected for laboratory analysis to determine plating bath surface tension and chromic acid content.

B. Analytical Procedures

Laboratory analyses for hexavalent and total chromium of the collected stack samples was performed by ARB's Northern Laboratory Branch. Hexavalent chromium (also known as hex chrome, Cr (VI), or Cr^{+6}) was measured using ion

chromatography (IC) in accordance with ARB standard operating procedure (SOP) MLD039. The limit of detection (LOD) of the analytical procedure for hexavalent chromium is 0.2 nanograms per milliliter (ng/ml). Total chromium was determined using an atomic absorption/ graphite furnace (GFAA) technique using ARB SOP MLD005. The LOD of the analytical procedure for total chromium is 1.0 ng/ml.

V. QUALITY ASSURANCE / QUALITY CONTROL

To ensure that collected data are consistent, relevant, and defensible, appropriate field and laboratory Quality Assurance (QA) procedures were followed throughout the source test. A detailed explanation of the ARB's standard field and laboratory QA procedures are contained in ARB Quality Assurance manuals, Stationary Source Test Methods, and laboratory SOPs.

As required by ARB Method 425, all surfaces that came into contact with a sample were either glass or Teflon™ and were pre-cleaned using the following procedure:

- the glassware and Teflon™ lines were first washed with detergent;
- soaked with a 10% solution of nitric acid for several hours;
- flushed with liberal amounts of tap water;
- rinsed with de-ionized water; and
- rinsed with 0.1 N sodium bicarbonate solution.

Extra pre-cleaned equipment was deployed to ensure that no equipment needed to be re-cleaned or re-used during field sampling.

A blank source test (Run W-14) sample was collected at Walker's with the ARB capture hood and ducting after sampling. Run W-14 was collected similar to runs W-12 and W-13. No changes were made to the sampling results based upon the results of Run W-14.

The Type S Pitot tubes used for stack velocity determinations met the required specifications for a baseline coefficient of 0.84 as specified in ARB Method 2. The console assembly, including Pitot tubes, passed leak checks before and after each velocity determination. In addition, all sampling train assemblies passed leak checks before and after each sample run.

All test samples were collected using iced impinger sets. After recovery, samples were placed on ice to maintain their temperature at or below 4 °C (39 °F) as required by ARB Method 425. Collected and recovered samples remained on ice while on site and during transport to the laboratory for analyses. Staff of the Northern Laboratory Branch ensured that the samples were maintained at or below 4 °C (39 °F) in a sample refrigerator while awaiting analysis.

During sample collection and transport, the pH of the sodium bicarbonate solution used for the probe rinse and impinger charging was maintained at ≥ 8.0 as required by Method 425. This is necessary to ensure that any collected hexavalent chromium is not reduced to trivalent chromium. The pH of the impinger solutions and sample train rinses were checked before sampling and during sample recovery.

Chain of custody was maintained for all collected samples. A chain of custody sheet was prepared for each sample run.

VI. TEST RESULTS

Results of the ARB Method 425 source tests for Walker's Custom Chrome decorative chromium plating tank are presented in Table VI-1. Chromium emission rates ranged from 0.0050 to 0.016 milligrams per amp-hour (mg/amp-hr) for total chromium and 0.0037 to 0.012 mg/amp-hr for hexavalent chromium at a surface tension of about 35 dynes/cm. Emissions data and calculations are in Appendix A. Laboratory results are presented in Appendix B.

There seems to be a significant difference in the emissions measured with Run W-11 compared to emissions measured with Runs W-12 and W-13. The reason for the difference is not known. Run W-11 sampled for two hours on a single traverse compared to four hours sampling on two traverses, 90^{o} apart, for each of the other two sample runs. For Run W-11, amp-hours were higher and surface tension slightly lower than for Runs W-12 and W-13.

Table VI
Walker's Custom Chrome Chromium Plating Tank
Sampling Dates – February 15-23, 2006

Sampling Location			
Sample Number	W-11	W-12	W-13
Sampling Date	2/15/06	2/16/06	2/17/06
Plating Tank Data			
Totalizer (amp-hours)	331	300	300
Production Rate (amp-hrs/hr)	165.5	75	75
Freeboard (inches to overflow)	4.75	4.5	5
Surface Tension (dynes/cm)	35.1	35.4	35.4
Chromic Acid Conc. (oz/gal)	34.8	34.8	34.8
Bath Temperature (^{o}F)	90-100	92-105	98-107
Stack Data			
Stack Temperature (^{0}F)	65	61	61
Velocity (ft/sec)	19.2	20.2	21.6
Static Pressure ("H_20)	-0.26	-0.24	-0.25
Stack Area (sq. ft.)	0.785	0.785	0.785
Flow Rate (DSCFM)	899	958	1000
Moisture (% of v/v)	0.7	0.5	0.9
Sampling Data			
Sampling Time (minutes)	120	240	240
Sample Volume (DSCF)	110.56	233.10	235.72
Chromium Data (ng/sample)			
Total Chromium	1700	5090	4680
Hexavalent Chromium	1262	3232	3610
Isokinetic Rate (%)	105	104	101
EMISSIONS			
Concentration (ng/dscm)			
Total Chromium	543	771	701
Hexavalent Chromium	403	490	541
Emission Rate (mg/hr)			
Total Chromium	0.83	1.25	1.19
Hexavalent Chromium	0.62	0.80	0.92
Emissions Factors (mg/amp-hr)			
Total Chromium	**0.0050**	**0.017**	**0.016**
Hexavalent Chromium	**0.0037**	**0.011**	**0.012**

Standard Conditions = 68^{o} F and 29.92 in. Hg. DSCF = dry standard cubic feet. DSCM = dry standard cubic meter. DSCFM = dry standard cubic feet per minute.

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Appendix A

ARB Sampling Results

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MONITORING & LABORATORY DIVISION
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: 06-05
PROJECT NAME: Walker's Chrome
RUN NO.: W-11

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	111.72	cubic feet
Vm Meter Cal. Factor (Y)	0.973	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.79	inches Hg
Avg. delta H Orifice Press. (dH avg):	2.442	inches H2O
Pb + dH avg:	29.97	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.34	/(inches H2O)
Stack Temperature (Ts)	525	deg. R
Static Pressure	-0.26	inches H2O
Absolute Stack Pressure (Ps)	29.77	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	16.7	milliliters
Sampling Time (t):	120	minutes
Nozzle Diameter (Dn):	0.375	inches
Total Chromium Mass Collected (Mn):	1,700	nanograms
Hexavalent Cr. Mass Collected (Mn):	1,262	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	110.56	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.7	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.76	lb/lbmole
Stack Gas Velocity (Vs):	19.20	feet/second
Stack Gas Flow Rate (Qs):	899	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	105.0	percent
Total Cr Mass Conc. (Cs):	15.376453	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	11.414755	nanograms/dscf
Total Cr Mass Conc:	543	nanograms/dscm
Hex. Cr. Mass Conc:	403	nanograms/dscm
Total Cr. Emission Rate (Wm):	0.83	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	0.62	milligrams/hr Hex. Cr.

During Run W-11 plating was twice as fast as designed. As a result the test run was 2 hours instead of 4 and only one diagonal was sampled instead of two.

MONITORING & LABORATORY DIVISION
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: 06-05
PROJECT NAME: Walker's Chrome
RUN NO.: W-12

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	234.74	cubic feet
Vm Meter Cal. Factor (Y)	0.973	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.87	inches Hg
Avg. delta H Orifice Press. (dH avg):	2.758	inches H2O
Pb + dH avg:	30.07	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.36	/(inches H2O)
Stack Temperature (Ts)	521	deg. R
Static Pressure	-0.24	inches H2O
Absolute Stack Pressure (Ps)	29.85	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	26.7	milliliters
Sampling Time (t):	240	minutes
Nozzle Diameter (Dn):	0.375	inches
Total Chromium Mass Collected (Mn):	5,090	nanograms
Hexavalent Cr. Mass Collected (Mn):	3,232	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	233.10	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.5	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.78	lb/lbmole
Stack Gas Velocity (Vs):	20.21	feet/second
Stack Gas Flow Rate (Qs):	958	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	103.9	percent
Total Cr Mass Conc. (Cs):	21.836082	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	13.865269	nanograms/dscf
Total Cr Mass Conc:	771	nanograms/dscm
Hex. Cr. Mass Conc:	490	nanograms/dscm
Total Cr. Emission Rate (Wm):	1.25	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	0.80	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: 06-05
PROJECT NAME: Walker's Chrome
RUN NO.: W-13

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	242.52	cubic feet
Vm Meter Cal. Factor (Y)	0.973	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.22	inches Hg
Avg. delta H Orifice Press. (dH avg):	2.925	inches H2O
Pb + dH avg:	29.44	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.38	/(inches H2O)
Stack Temperature (Ts)	521	deg. R
Static Pressure	-0.25	inches H2O
Absolute Stack Pressure (Ps)	29.20	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	44.7	milliliters
Sampling Time (t):	240	minutes
Nozzle Diameter (Dn):	0.375	inches
Total Chromium Mass Collected (Mn):	4,680	nanograms
Hexavalent Cr. Mass Collected (Mn):	3,610	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	235.72	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.9	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.74	lb/lbmole
Stack Gas Velocity (Vs):	21.63	feet/second
Stack Gas Flow Rate (Qs):	1000	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	100.6	percent
Total Cr Mass Conc. (Cs):	19.854152	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	15.314848	nanograms/dscf
Total Cr Mass Conc:	701	nanograms/dscm
Hex. Cr. Mass Conc:	541	nanograms/dscm
Total Cr. Emission Rate (Wm):	1.19	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	0.92	milligrams/hr Hex. Cr.

MONITORING & LABORATORY DIVISION
STATIONARY SOURCE TEST BRANCH

TEST SUMMARY AND RESULTS
(FOR FIELD DATA RECORD)

FILE NO.: 06-05
PROJECT NAME: Walker's Chrome
RUN NO.: W-14

SUMMARY OF TEST DATA

Volume of Gas Sampled (Vm):	230.59	cubic feet
Vm Meter Cal. Factor (Y)	0.973	
Meter Temperature (Tm):	520	deg. R
Barometric Pressure (Pb):	29.42	inches Hg
Avg. delta H Orifice Press. (dH avg):	2.708	inches H2O
Pb + dH avg:	29.62	inches Hg.
O2 in Stack (%O2):	20.90	percent
CO in Stack (%CO):	0.0000	percent
CO2 in Stack (%CO2):	0.00	percent
N2 in Stack (%N2):	79.10	percent
Pitot Tube Factor (Cp)	0.84	
Avg. of Sqrt. of Pitot Press. (/dP avg):	0.37	/(inches H2O)
Stack Temperature (Ts)	532	deg. R
Static Pressure	-0.24	inches H2O
Absolute Stack Pressure (Ps)	29.40	inches Hg
Stack Dimensions	12	inches dia.
Stack Area (As)	0.785	square feet
H2O in Impingers and Silica Gel (Vlc):	26.6	milliliters
Sampling Time (t):	240	minutes
Nozzle Diameter (Dn):	0.375	inches
Total Chromium Mass Collected (Mn):	1,010	nanograms
Hexavalent Cr. Mass Collected (Mn):	317	nanograms

CALCULATED RESULTS

Corrected Sample Volume (Vm std):	225.53	DSCF (68 deg.F)
Water Vapor in Stack (Bws):	0.6	percent by volume
Stack Gas Molecular Wt, Dry (Md):	28.84	lb/lbmole
Stack Gas Molecular Wt, Wet	28.78	lb/lbmole
Stack Gas Velocity (Vs):	20.92	feet/second
Stack Gas Flow Rate (Qs):	956	DSCFM(68 deg.F)
Isokinetic Ratio (%I):	100.7	percent
Total Cr Mass Conc. (Cs):	4.4784383	nanograms/dscf
Hex. Cr. Mass Conc. (Cs):	1.4056089	nanograms/dscf
Total Cr Mass Conc:	158	nanograms/dscm
Hex. Cr. Mass Conc:	50	nanograms/dscm
Total Cr. Emission Rate (Wm):	0.26	milligrams/hr Total Cr.
Hex. Cr. Emission Rate (Wm):	0.08	milligrams/hr Hex. Cr.

Run W-14 was run similar to W-12 and W-13 but without any plating in the tank during Run W-14. Amp-hours and amp-hours/hour were zero and bath temperature was 104^{o}F.

Appendix B

Laboratory Results

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Chromium Source Testing Results
Project: Walker's Custom Chrome
Sample Collection: February 2006

Probes and Impingers

Sample ID	*ml of sample collected*	*Total Cr ng/ml*	**Total Cr ng recovered**	*Cr(VI) ng/ml*	**Cr(VI) ng recovered**	Cr (VI) as % of Total Cr
W11-P	82.7	13.0	**1100**	8.2	**680**	61.8%
W11-I1	104.6	5.7	**600**	5.3	**550**	91.7%
W11-I2	105.7	<1.0	**<110**	0.3	**32**	
		Totals:	**1,700**		**1,262**	**74.2%**
W12-P	78.6	54.0	**4300**	33.0	**2600**	60.5%
W12-I1	93.2	7.3	**680**	6.3	**590**	86.8%
W12-I2	103.8	1.1	**110**	0.4	**42**	38.2%
		Totals:	**5,090**		**3,232**	**63.5%**
W13-P	103.0	28.0	**2900**	18.0	**1900**	65.5%
W13-I1	106.1	15.0	**1600**	15.0	**1600**	100.0%
W13-I2	105.1	1.7	**180**	1.0	**110**	61.1%
		Totals:	**4,680**		**3,610**	**77.1%**
W14-P	73.8	8.7	**640**	2.7	**200**	31.3%
W14-I1	93.8	2.5	**230**	0.7	**66**	28.7%
W14-I2	101.3	1.4	**140**	0.5	**51**	36.4%
		Totals:	**1,010**		**317**	**31.4%**

The limit of detection (LOD) for Cr by GFAA is 1.0 ng/ml. The LOD for Cr 6+ by IC is 0.2 ng/ml.

Chromium Source Testing Results
Project: Walkers Chrome

Date Analyzed	Sample ID	ml of sample collected	Total Cr ng/ml	Total Cr ng recovered	Cr(VI) ng/ml	Cr(VI) ng recovered
3/28/2006	W11-I1	104.6	5.7	600	5.3	550
3/28/2006	W11-I2	105.7	<1.0	<110	0.3	32
3/28/2006	W11-Probe	82.7	13	1100	8.2	680
3/28/2006	W12-I1	93.2	7.3	680	6.3	590
3/28/2006	W12-I2	103.8	1.1	110	0.4	42
3/28/2006	W12-Probe	78.6	54	4300	33	2600
3/28/2006	W12-Probe	78.6	54	4300	34	2600
3/28/2006	W13-I1	106.1	15	1600	15	1600
3/28/2006	W13-I2	105.2	1.7	180	1	110
3/28/2006	W13-Probe	103	28	2900	18	1900
3/28/2006	W14-I1	93.8	2.5	230	0.7	66
3/28/2006	W14-I2	101.3	1.4	140	0.5	51
3/28/2006	W14-Probe	73.8	8.7	640	2.7	200

Subject: Walker Chrome plating bath analysis by Anachem
Date: Tue, 16 May 2006 08:25:37 -0700
From: Robert Barrera <rbarrera@arb.ca.gov>
To: David Todd <dtodd@arb.ca.gov>, Carla Takemoto <ctakemot@arb.ca.gov>

The analysis on the chromium plating bath sample from Walker's has been completed except for the Hull Cell test. The results are as follows:

Date: May 11, 2006
Lab#: B16229
SA# 054005

Chromic Acid	34.8 oz/gal
Sulfate	0.40 oz/gal
Ratio	87/1
Trivalent Chromium	0.5%
Surface Tension	28.9 dynes/cm
Baume	24.4
Chloride	<25 mg/L
Iron	0.91 g/L
Copper	2.08 g/L
Zinc	0.51 g/L

The Hull Cell result will be in this week.

Robert Barrera <rbarrera@arb.ca.gov>
Air Resources Engineer
California Air Resources Board
Stationary Source Division

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